



Via Electronic Comment Filing System

November 1, 2019

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: *Notice of ex parte filing of iRobot Related to
Unlicensed Use of the 6GHz Band, Expanding Flexible Use in the Mid-
Band Spectrum Between 3.7 and 24 GHz, ET Docket No. 18-295, GN
Docket No. 17-183*

Dear Ms. Dortch:

By this letter, and pursuant to Sections 1.1206 of the Commission's rules,¹ iRobot files this notice of a meeting on October 30, 2019. Representatives of iRobot, Tonya Drake, Ira Renfrew, and Erik Steltz, and Gregory Guice, counsel for iRobot, met with Julius Knapp, Michael Ha, Apasia Paroutsas, Hugh Van Tuyl, Nicholas Oros, and Karen Rackley of the Office of Engineering and Technology, concerning the above-listed proceeding.² iRobot presented the attached presentation that outlines the interference to ultra-wide band (UWB) devices that would be caused by Wi-Fi devices operating at power levels proposed in the Commission's Notice of Proposed Rulemaking in the 6GHz proceeding. The interference is based on an independent report iRobot (*Roberson Report*) submitted for the record on October 18, 2019.³

iRobot explained that unlicensed devices, specifically UWB devices, are currently permitted to operate in the 6GHz band pursuant to the Commission's existing Part 15 rules.⁴ iRobot further explained that UWB devices are currently on the market and that consumers and businesses are using them for a range of applications as iRobot previously set forth in its *September Ex Parte* filing in this docket.⁵ As set forth in the presentation and in more detail in

¹ 47 C.F.R. § 1.1206.

² *Unlicensed Use of the 6GHz Band, Expanding Flexible Use in the Mid-Band Spectrum Between 3.7 and 24 GHz*, ET Docket No. 18-295, GN Docket No. 17-183; Notice of Proposed Rulemaking.

³ Letter from Tonya Drake, VP and Asst. Gen. Counsel, iRobot to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 18-295 (filed Oct. 17, 2019) (*Roberson Report Ex Parte*).

⁴ 47 C.F.R. §§ 15.501-15.525.

⁵ Letter from Tonya Drake, Vice President and Asst. General Counsel, iRobot Corp., to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 18-295, GN Docket No. 17-183, filed Sept. 17, 2019 (*September Ex Parte*). In that ex parte, iRobot cited findings in the European Communications Commission Report, submitted in the record by the proponents of opening the 6GHz band to Wi-Fi, that there is a current installed base of greater than 2 million (some at the 6.5GHz band) with projected growth to 3.1 billion devices by 2025. Letter from E. Austin Bonner, Counsel to Broadcom, Inc., Harris Wiltshire & Grannis, to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 18-295 (filed Aug. 13, 2019) (*citing* European Communications Committee, European Conference on Postal and Telecommunications (CEPT), ECC Report 302:



the *Roberson Report* submitted by iRobot,⁶ the introduction of Wi-Fi devices, consistent with the Commission's 6GHz NPRM, would render inoperable its Terra robotic lawn mower, a finding that is wholly consistent with the *ECC Report* that "the impact on UWB would be severe."⁷

iRobot made clear in the meeting that its goal is to work with other stakeholders, including the Wi-Fi proponents, utilities, public safety, and other licensed users to find a solution that can accommodate the various needs of these entities. UWB uses a very low energy level for short range, high bandwidth communications and requires 500 MHz of contiguous spectrum for communications to work. Moreover, UWB is an unlicensed technology that currently co-exists with licensed uses in the 6GHz band.

As iRobot explained, manipulation of allowable power levels for Wi-Fi and UWB devices and duty cycle restrictions may be a possible solution, though the drastically higher allowed power levels for Wi-Fi devices as opposed to UWB devices under consideration by the Commission makes this challenging.

Alternatively, splitting the band to accommodate UWB, licensed and other users in a 500 MHz portion, while allowing Wi-Fi operation in a remaining 700 MHz portion of the band, may be a more viable path to accommodating existing unlicensed and licensed uses as well as the introduction of Wi-Fi into the band.⁸

As iRobot made clear in its meeting, its goal in putting forward its policy solution, based on data from the *Roberson Report* and its own research, is to seek to initiate a process by which stakeholders convene to find a solution that will allow opportunities for all stakeholders to move forward with their current and future uses of the 6GHz band.

Please direct any questions to the undersigned.

Gregory Guice
Counsel for iRobot
McGuire Woods, LLP
2001 K Street, NW
Washington, DC 20006
(202) 857-2916

Sharing and compatibility studies related to Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) in the frequency band 5925-6425MHz, available at <https://www.ecodocdb.dk/download/cc03c766-35f8/ECC%20Report%20302.pdf> (*ECC Report*).

⁶ *Roberson Report Ex Parte*.

⁷ *ECC Report* at 138.

⁸ A recent ex parte filing by a number of proponents recognizes that "a balanced spectrum policy supports opening the entire 1200 MHz of the 6 GHz band for Wi-Fi and *other unlicensed technologies*." Letter from Apple Inc. Broadcom Inc. Cisco Systems, Inc. Facebook, Inc. Hewlett Packard Enterprise Microsoft Corporation Ruckus Networks, a Business Segment of CommScope, to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 18-295, GN Docket No. 17-183, at 2 (filed Oct. 23, 2019). Under the Commission's existing rules, the 6 GHz band is already open to UWB, which is an unlicensed technology. We agree with these parties that a balanced spectrum policy would accommodate not only Wi-Fi but such other unlicensed technologies.



Protecting Innovation

Terra UWB and Wi-Fi Coexistence Analysis

10/30/2019

iRobot Terra Robotic Lawn Mower

Concerned about 6GHz NPRM and its effect on the Terra product

- iRobot is the global leader in consumer robotics
- Headquartered near Boston, we employ ~800 full-time staff in high-wage jobs in USA
- Key player in ensuring that the United States maintains global leadership in consumer robotics
- Terra is an autonomous robotic lawn mower with innovative mapping technology
- FCC-authorized to use fixed UWB “beacons” outdoors to localize within the yard
 - 6.5GHz centered, 500MHz
 - Very low duty cycle, two-way ranging messages – does not interfere with existing spectrum users
 - Received FCC waiver in 2015 for fixed outdoor beacons and began productization



Findings: High chance to be rendered unusable

Simulated iRobot Terra lawn mower with 6 GHz Wi-Fi APs active in neighborhood

If Wi-Fi traffic is:

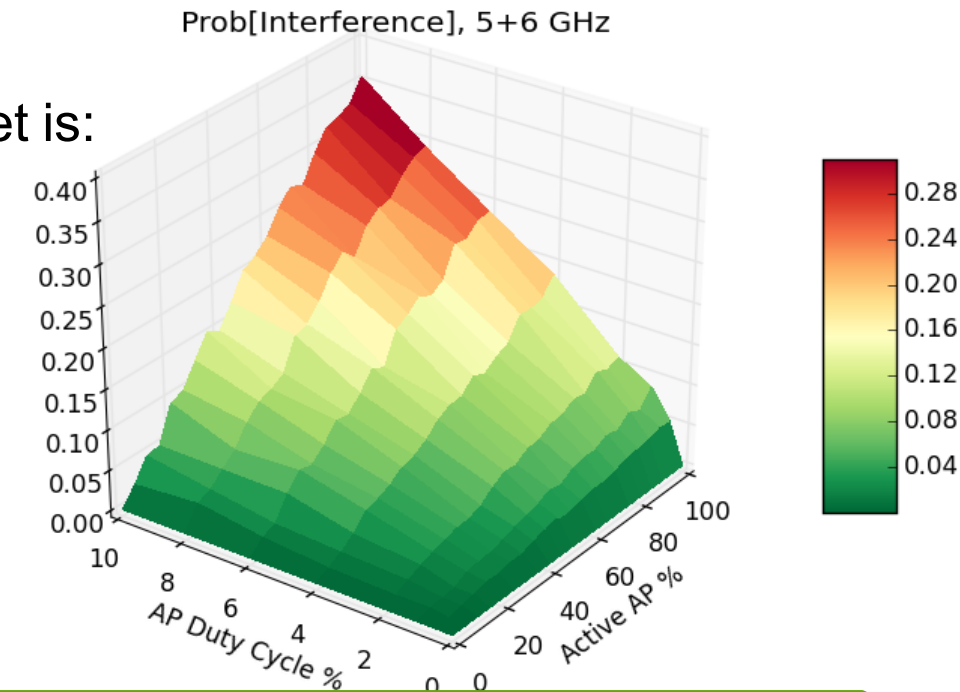
- Evenly distributed over all available frequencies/channels in the 5GHz and 6-7GHz range
- Houses have a **single** router (AP) streaming 4k video to a **single** client device

Then **interference probability** for each Terra UWB ranging packet is:

- Up to 35% at 10% neighborhood AP duty cycle
- 10% at 2% neighborhood AP duty cycle

These interference levels will prevent Terra from localizing

- Due to safety standards, the mower may NOT move if not localized



The iRobot Terra will be rendered inoperable in the presence of widely deployed 6-7GHz Wi-Fi

Assumptions: realistic & conservative

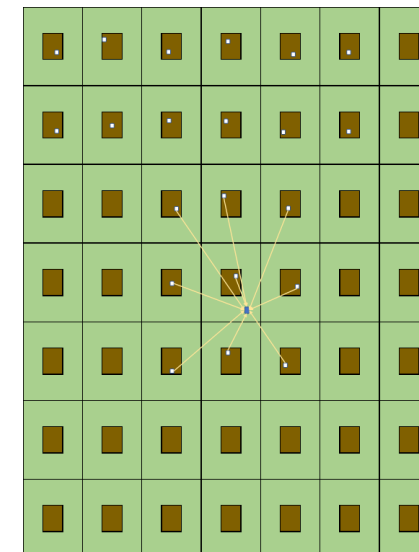
Environment

- Homes on a grid with all ¼ acre properties
- One 6-7GHz access point per house – no backhaul traffic (mesh routers)
- 11dB building entry/exit loss
- Only one single outdoor AP in line of sight to Terra in the neighborhood

AP Usage

- Effect of duty cycles of APs plotted from 0-10% when streaming 4k video
 - Have not considered 8k video
- Streaming 4k video to a single client device in the house
- Using only 160MHz channels in 6-7GHz range
- Traffic evenly distributed across all available 5GHz, proposed 6-7GHz channels
- Bit rate is sustained at 1Gbps (QAM 1024) and does not drop
- Power levels taken from NPRM levels
- 0dBi antennas (6dBi allowed in NPRM)
- NLOS paths for interference calculation

¼ acre plot neighborhood



Provider	4K Recommended Rate (Mbps)	Duty Cycle at 250 Mbps	Duty Cycle at 1000 Mbps
You Tube	35-45	14-18%	3.5-4.5%
Amazon	At least 15	6%	1.5%
Netflix	25	10%	2.5%

Even in the presence of many conservative assumptions, interference to UWB is extremely high

Next Steps

We are setting up a real-world experiment to verify simulation results

- Single AP at 6-7GHz, single mower interference victim in an outdoor environment
- 6-7GHz APs not publicly available – slowing our ability to test

We are also examining coexistence techniques through simulation of:

- Lower power levels for Wi-Fi & higher transmit power levels for UWB

→ Initial results:

- Power level alone will not ensure coexistence as Wi-Fi duty cycle rises significantly with lower link margin at lower transmit powers
- Interference depends on both power and duty cycle

Discussion:

- AFC does NOT help consumer devices
- Power level and duty cycle restrictions together
 - Precedence with LDC rules for wideband in other regions
- Splitting the band
 - Wideband devices need a minimum of 500MHz of bandwidth
 - Need to consider OOB for WiFi if on an adjacent band



Backup

Holding throughput constant rather than duty cycle

